

Draft Recommendations by the California Carbon Capture and Storage Review Panel

December 2010

Executive Summary

What is Carbon Capture and Storage Technology?

Carbon Capture and Storage (CCS) refers to the capture, or removal, of carbon dioxide (CO₂) at large industrial sources and its subsequent compression, transport, and injection into the subsurface for long term or permanent storage. CCS is one of the options in a portfolio of mitigation tools to achieve California's greenhouse gas emission goals as required under Assembly Bill 32 (the Global Warming Solutions Act, Chapter 488; Statutes of 2006). CCS is also an important strategy for retrofitting coal and natural gas power plants to reduce their carbon footprint. Other sources and technologies, such as energy efficiency and renewable electricity, will remain cornerstones of California's efforts to control greenhouse gases.

To justify capital investments in CCS technology, private industry needs certainty in how CCS will be regulated, how carbon will be valued as a commodity, and how carbon credits will be obtained under a state-administered cap-and-trade program. Private companies have expressed reluctance to commit substantial and long-term investments in a changing and uncertain regulatory climate.

If CCS is to play a role in achieving California's greenhouse gas reduction goals, a clear and consistent regulatory and policy framework must be established. The framework should clearly establish the roles and authorities of the involved state agencies, facilitate and streamline permitting processes, and serve the public's interest in assuring climate change mitigation goals are met while protecting the environment and human health and safety.

A statutory or regulatory framework for CCS must be clear, transparent, flexible and adaptable. There is a need for a clearly articulated state policy which recognizes the value of CCS technology as marketable commodity and as a GHG reduction strategy. Lastly, there must be clear rules on permitting and regulating CCS projects. Consistent reporting protocols should be established for monitoring, measurement and verification of the volume of GHG emissions sequestered, and a GHG accounting method should be established that gives carbon credits to CCS development projects which help industry satisfy their AB 32 obligations.

Why was the Carbon Capture and Storage Review Panel formed?

Recognizing the importance of CCS for California's industrial and electricity sectors, the California Public Utilities Commission (CPUC), California Energy Commission (CEC) and the Air Resources Board (ARB) created a CCS Review Panel composed of experts from industry, trade groups, academia, and environmental organizations in February 2010. The Panel was asked to:

1. Identify, discuss, and frame specific policies addressing the role of CCS technology in meeting the State's energy needs and greenhouse gas emissions reduction goals for 2020 and 2050.
2. Support development of a comprehensive legal/regulatory framework for permitting proposed CCS projects consistent with the State's energy and environmental policy objectives.

The Panel held five public meetings on April 22, June 2, August 18, October 21, and December 15, 2010, to arrive at its findings and recommendations. These meetings were designed to solicit input from technical experts and key stakeholders and to allow the Panel to deliberate among themselves in an open, public setting. The Panel was asked to submit its written recommendations to the three principal agencies by the end of 2010.

What are the key issues facing CCS development projects?

A number of key legal and regulatory issues require greater clarity and possible legislative action. In addition, information is also required to assess the potential of CCS as a greenhouse gas reduction strategy under Assembly Bill (AB) 32. (Note: Reorder these questions in the order the recommendations are listed in the Report.)

1. Who owns the subsurface “pore space” where CO₂ is stored? Should California law be amended to allow for eminent domain for CCS projects that are deemed to be in the public interest?
2. What regulatory and monitoring requirements are needed to allow CO₂ emissions to be permanently stored in subsurface geologic reservoirs?
3. Which agency should be the lead for permitting CCS development projects? Who are the responsible agencies?
4. Which agency should regulate CO₂ pipelines?
5. Who should bear the long-term financial liability for any economic or environmental damages?
6. Who should be responsible for the long-term stewardship of conducting post-closure operations?
7. How should industry be given carbon credits under a state-administered cap-and-trade program or mandatory reporting requirements established under AB 32?
8. Is there a need for GHG accounting protocols to allow CCS projects to comply with the ARB’s AB 32 requirements?
9. Should a performance standard for geologic sequestration projects be established to accurately measure the amount of CO₂ that is sequestered?
10. Should state policy explicitly recognize CO₂ as a valuable commodity that can generate revenue from the production of chemicals, fuels, fertilizers, and other co-products?

The Panel has deliberated on these issues and has put forth the following key findings and recommendations for consideration by the three principal agencies.

Notional Findings:

1. Carbon dioxide (CO₂) is a valuable and marketable commodity, and there is a public benefit from geologic storage of CO₂ in reducing GHG emissions to the atmosphere.
2. Cost and related lack of economic drivers, regulatory uncertainty, and an inadequate legal framework for CO₂ storage are the primary barriers to near-term deployment of commercial scale CCS projects.
3. There is presently no single state or federal agency responsible for permitting CCS development projects.
4. There is a need for clear and consistent regulatory requirements for permitting first-of-its kind demonstration projects in California.
5. Consistent reporting requirements are needed for monitoring, measuring and verifying CO₂ releases, and for GHG accounting protocols necessary for AB 32 compliance.
6. Performance standards are needed for geologic storage projects to identify an acceptable level of leakage (e.g. 99 capture and retention over a thousand years).

7. Post-closure monitoring by the drilling and reservoir operator should continue for a period of 10 years or longer, after CO₂ injection ceases.
8. A fee-based structure should be established for long-term stewardship of a CO₂ reservoir.
9. The responsibility for long-term financial liability should rest with the CCS developer; until such time that the state or federal government is willing to assume this risk.
10. Carbon credits for CCS development projects should be quantified and allowed as part of a state-administered cap-and-trade program.
11. Ownership of pore space should either be clarified in legislation or determined on a case-by-case basis through negotiated agreements between developers and surface property owners. Property owners should be fairly compensated for the use of their land for CCS development.
12. Further research is needed to develop or adapt existing measurement tools and modeling protocols for geologic CCS projects
13. There was general agreement on the need for public education on the technical and financial risks associated with CCS technology and mitigation.
14. Much, if not most, of the potential benefits of CCS derive from the technology's potential to retain or expand economic activity within California – benefits that flow to the general economy and not to the balance sheet of electric utilities using CCS. This could result in a situation in which the full potential of CCS is not realized because those most impacted by the economic burden are not those who benefit most by advancing the technology.

Notional recommendations:

1. The State should clearly identify CCS as a measure that can reduce carbon and that allows carbon credits under a state-administered cap-and-trade program. To that end, the ARB should develop GHG reporting protocols for CCS projects.
2. The State should consider legislation authorizing the use of eminent domain for CO₂ pipelines that are not owned or operated by public utilities. The legislation should clarify the ownership of “pore space” and ensure that property owners are justly compensated for the use of their land for CCS development. Alternately, the State should establish a process by which the rights of property owners are fairly adjudicated.
3. The State should consider legislation that identifies either the CPUC or the State Fire Marshall as the lead agency for regulating CO₂ pipelines.
4. The State should identify a lead agency for administering post-closure operations, and for establishing monitoring, measurement and verification (MMV) requirements for permitting CCS projects.
5. The State should consider legislation establishing a fee-based fund structure to be used for long-term stewardship.
6. The Panel endorses the need for a well thought-out and well-funded public outreach program to ensure that the risks and benefits of CCS technology are effectively communicated to the public.

7. The State should establish and administer a program to insure against the long-term risk of irregular CO₂ behaviour in the reservoir, in concert with the federal government.
8. The State should consider legislation designating the Energy Commission as the lead permitting projects for all CCS projects (both stand-alone and retrofit projects).
9. The CEC should consult with the responsible permitting agencies in carrying out its responsibilities. Specifically, the CEC should consult with the Division of Oil, Gas and Geothermal Resources (DOGGR) for its technical expertise associated with oil and gas development and incorporate the DOGGR requirements into the CEC permit process.
10. The State of California should evaluate the pending EPA regulations and determine whether and who should seek “primacy” for permitting CCS wells.
11. The State should establish one set of performance and remediation standards for geologic storage projects that demonstrate, with a high degree of confidence, 99 percent retention over a thousand years. These standards should measure the quantity and permanence of CO₂ sequestered.
12. Methodology to stimulate early mover CCS projects should be considered.

AB 32 and its Applicability to Carbon Capture & Sequestration

The major policy driver for CCS technology development in California was the enactment of the Global Warming Solutions Act of 2006 (Assembly Bill 32, Chapter 488, Statutes of 2006). This landmark legislation declares global warming as a serious threat to California's environment and economy. The law requires a reduction in statewide GHG emissions to 1990 levels by the year 2020. In addition Executive Order S-3-05 signed June 1, 2005 set a 2050 greenhouse gas reduction target of 80 percent below 1990 levels.

Under AB 32, the California Air Resources Board (ARB) is the lead agency for developing a comprehensive, multi-year program to reduce GHG emissions in California. Under its authority from AB 32, the ARB is establishing regulations, programs and reporting requirements, including:

- The Low-Carbon Fuel Standard requiring a 10 percent reduction in the carbon intensity of liquid transportation fuels by 2020
- Mandatory reporting requirements for major GHG emitters
- Specific GHG reducing measures
- A cap-and-trade program which allows the trading of emission allowances or offset credits among participants in the emerging carbon market.

The Climate Change Scoping Plan, which the ARB adopted in December 2008, recognizes the important role of CCS as a long-term (post-2020) strategy. CCS is specified by ARB as an option for lowering the carbon intensity of high carbon intensity crude oil. However, the Scoping Plan does not measure the potential GHG reductions from this technology nor does it provide a reporting mechanism for measuring CO₂ emission reductions from CCS technology.

It is not yet clear whether or how CCS developers will be given credit for carbon reductions either under the ARB's mandatory reporting rules or under a proposed cap-and-trade program. One option is for ARB to allow CCS-related reductions as offsets or allowances that can be sold in the market to major GHG emitters. Another option would be for ARB to adopt GHG reporting protocols for CCS projects that could be used to measure and verify CO₂ reductions. In any case, a methodology for quantifying the effects of CCS technology would need to be developed, so that carbon credits will be available to mitigate the high capital costs of CCS development projects.

Recommendation:

- The ARB should clearly identify CCS as a measure that can reduce carbon and that will be given carbon credits under a state-administered cap-and-trade program. To that end, the ARB should develop GHG reporting protocols for CCS projects.

Permitting CCS Projects in California

There is no one single lead agency for the permitting of carbon capture and sequestration projects in California. The current permitting process involves a multitude of federal, state, regional and local agencies, each with its unique authorities and regulatory requirements. Often, the agencies act independent of one another, and permitting timeframes are not always closely coordinated. Currently, multi-agency permitting has been time-consuming and costly for CCS developers, causing uncertainty and risk for the first commercial demonstration projects.

In addition, gaps exist in how California regulations apply to geologic CCS projects, and especially CCS project that do not involve Enhanced Oil Recovery (EOR). These gaps will either be addressed by the US EPA in its proposed rulemaking on CCS, by the establishment of Memorandum of Understanding among agencies, or by an application from a designated state regulatory agency to obtain “primacy” over CCS injection wells.

Coordination among regulatory agencies can be further improved through a Memoranda of Understanding (MOU), especially where there is overlap or the potential for duplication of regulatory requirements. An MOU can also serve to designate the lead agency, to clarify the regulatory jurisdiction, and to improve coordination among the involved regulatory agencies.

Any legal or regulatory framework that is established for permitting CCS projects should be clear and transparent. It should provide needed guidance to project developers on specific regulatory requirements. In addition, such a framework should balance the need for regulatory certainty with the need to protect public health and safety and the environment. Such a framework should aim to:

- Maintain consistency in state permitting requirements for all types of geologic CCS projects;
- Clarify the respective roles and boundaries of each of the agencies while reducing regulatory uncertainty; and
- Define specific regulatory requirements that provide guidance for early, first-of-its kind geologic CCS projects, until a permanent statutory or regulatory framework is established.

The Energy Commission's 12-month process for licensing electric power plants incorporates the requirements of state, local, or regional agencies into its “one stop” permitting process. The Energy Commission coordinates its review of the facility with other permitting agencies to ensure consistency between their requirements and its own conditions of certification. In the case of a power plant project that involves carbon capture and sequestration, the Energy Commission considers the environmental impacts of the entire facility and incorporates permit conditions to ensure that the CO₂ injection process is conducted in an environmentally safe manner.

For CCS projects not associated with thermal power plants, the Division of Oil, Gas and Geothermal Resources (DOGGR) has the authority to regulate CCS projects associated with oil and gas drilling, but does not have the authority nor the staff resources to assume the role of permitting stand-alone CCS projects, such as those involving saline formations. Under current law and regulation, DOGGR regulates the drilling and operation of wells that are classified as Class II wells under authority delegated from the U. S. Environmental Protection Agency (EPA). DOGGR sets requirements for any subsurface injection of fluids for enhanced recovery of oil or natural gas, or for fluids which are brought to the surface in connection with conventional oil or natural gas production.

The US EPA is the lead agency for the Underground Injection Control (UIC) program. EPA has delegated its authority for Class II well (EOR projects) to DOGGR. Through its proposed rulemaking, the US EPA is currently in the process of determining who will ultimately be the lead agency for permitting pure CCS projects. The US EPA is establishing regulations for CCS projects, under its existing authority for the UIC Program, including a new class of injection wells, Class VI, for geologic sequestration projects established by the “Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO₂) Geologic Sequestration (GS) Wells” published 12/10/2010.

Recommendations:

- Establish that the Energy Commission is the lead agency for permitting all CCS projects from stationary sources (i.e., refining, cement, and power generation) in California. This permitting role is to follow the chain of custody for the CCS project and does not apply or circumvent any other permitting requirements for the industrial facility.
- Instruct the permitting agency to request primacy for permitting CCS projects when appropriate.
- Assigning the Energy Commission the role of permitting CCS projects involving industrial development projects, such as oil refineries, cement plants, and ethanol production facilities, would create regulatory authority and would require new legislation. A Memorandum of Understanding should also be developed between the Energy Commission and the other responsible permitting agencies.
- Clarify that the Energy Commission must rely upon the Division of Oil, Gas and Geothermal Resources (DOGGR) for its technical expertise in the review of CCS projects associated with oil and gas development. The Commission should also consult with the other responsible permitting agencies and incorporate their permit requirements in its permitting process. Instruct the CEC to develop, in collaboration with DOGGR, performance standards for geologic sequestration sites that include design requirements and other operational measurements consistent with the goals to protect ground water and emissions in the atmosphere. This is to be done in consultation with the responsible agencies designated above and in addition, would utilize other expertise for mitigation and remediation.
- Instruct the CEC to develop performance standards for geologic sequestration sites that include design requirements and other operational measurements consistent with the goals to protect ground water and emissions in the atmosphere. This is to be done in consultation with the responsible agencies designated above and in addition, would utilize other expertise for mitigation and remediation.
- The State of California should evaluate the recent US EPA regulations and determine whether or not to seek primacy from EPA for the permitting of CCS wells.
- Exempt the use of CO₂ solely for EOR purposes.
- Recognize CCS as a mitigation measure under AB32. Instruct CARB to advance as a short-term goal, a CCS protocol to help expedite the utilization of CCS before 2020.

Recommendations on Performance Standards

The regulation of CCS must ensure both the safety of CCS operations and the permanence of sequestration. In particular, policymakers and regulators must ensure that performance standards are developed that give sequestration credit for GHG reductions, including for Enhanced Oil Recovery (EOR) operations.

Multiple California regulatory agencies could be involved in determining performance standards which ensure that injected CO₂ will be permanently contained. Appropriate standards will need to be developed that will measure the quantity of CO₂ sequestered and demonstrate that sequestration is permanent.

There will likely be differences in the detailed roles and responsibilities of the various State agencies involved in providing permits for CCS projects, and these differences may well lead to differences in permit requirements. While some differences are likely unavoidable, divergence in requirements, for monitoring, for example, could be a significant barrier to cost- and time-effective implementation of CCS. All agencies, however, share the common goal of assuring that ecosystems, local populations, and natural resources such as groundwater and recoverable oil and gas are protected, and that the proposed reductions in CO₂ emissions are achieved. It is recommended that a set of performance standards be developed which builds upon this common goal and strives to minimize any divergence in requirements between agencies.

Recommendations:

- The State should establish one set of performance standards for geologic storage projects that are consistent between agencies and consistent for all types of CO₂ emission sources.
- The state should define what constitutes a geologic storage project. The definition should be explicit in distinguishing a geologic storage project from an enhanced oil recovery project.
- The standards should include the need to demonstrate that a site, with a high degree of confidence, would retain 99% or more of the injected CO₂ for 1000 years
- The standards should define performance measures, including design requirements, monitoring requirements, and other measures, which are consistent with the policy goals of protecting human health and the environment, natural resources, including groundwater, and preventing emissions to the atmosphere
- The state should establish mitigation and remediation measures should leaks or other performance issues arise

Recommendation on Uses of Carbon Dioxide

In addition to using CO₂ for enhanced oil recovery (EOR), there are many other possibly beneficial and revenue-generating uses for captured CO₂ in various stages of development. Technologies for the beneficial use of CO₂ could advance greenhouse gas (GHG) reduction goals by either preventing the captured CO₂ from entering the atmosphere or by using the CO₂, or a chemical produced from CO₂, in a way that displaces the emission of other GHGs.

Technologies making beneficial use of CO₂ such as EOR have had a negligible impact on overall anthropogenic CO₂ emissions to date. The volumes of the current merchant and captive CO₂ markets combined amount only to about one percent of global anthropogenic CO₂ emissions. Furthermore, the current market demand for CO₂ is mostly addressed by geological sources of CO₂ (including essentially all of the CO₂ used in EOR).

Given the many existing and potential uses of CO₂, one option to consider would be for California to declare that CO₂ is a commodity. However declaring CO₂ to be a commodity could have implications on how, and by which agencies CO₂ capture and use is regulated, which need to be analyzed in detail.

There has been an expressed desire that non-geological sequestration strategies be formally recognized as a viable sequestration option, and that there be a more explicit recognition that CCS is broader than simply gas separation and geologic storage. These public comments also highlight how concerns involved with non-geological types of sequestration and CO₂ use will likely have different policy interests and priorities than ones involved with geological sequestration (GS).

For uses of CO₂ that involve GS such as the enhanced recovery of natural gas, geothermal heat, minerals, or water, it would appear possible that such technologies could be treated under a similar policy framework as EOR joined to CCS (CCS/EOR). However, it has been found that there may be significant differences between CCS/EOR and CCS in saline formations e.g. differences in monitoring, measurement, and verification (MMV), some differences under the new class VI UIC well classification, as well as possible differences in state permitting agencies.

Getting credit for emissions avoided that would have resulted from the production of conventional products is relevant to many of the non-GS CO₂ use technologies that do not sequester the CO₂ at all, but which still could reduce net GHG emissions, such as CO₂-to-fuel technologies.

Recommendation:

- Explicitly adopt a state policy which recognizes that CO₂ is a valuable commodity deserving of state support. Recognize non-GS beneficial uses of carbon, such as carbon conversion processes, as a viable sequestration or mitigation option.

Recommendations for Ownership of Pore Space for CO₂ Storage

There are no established rules in California that govern ownership or use of subsurface pore space for carbon sequestration. Yet, carbon sequestration cannot occur absent the right to inject and store CO₂. Therefore, in order for carbon sequestration to play a role in achieving California's climate goals, ownership of pore space rights needs to be clarified and statutory procedures need to be established for the acquisition of pore space rights. Further statutes can clarify which parties retain ownership of and liability for injected CO₂. Uncertainty about these issues creates risks for investors and landowners that will delay or prevent development of carbon sequestration projects in California if they remain unaddressed.

There are three basic approaches to acquiring pore space rights for carbon sequestration that have been discussed in recent years: 1) a traditional private property approach, 2) a limited private property approach, and 3) a public resource approach. Each approach has positives and negatives that would impact the rights of property owners, the rights of early movers in carbon sequestration development, the economics of carbon sequestration projects, and the level of regulatory infrastructure and public resources required.

A full analysis of these options that weighs the benefits and challenges of each, is provided in the *Report of the California Carbon Capture and Storage Review Panel*.

Traditional Private Property Approach.

The traditional private property approach recognizes that the right to use the pore space for the injection and sequestration of CO₂ is a property right that must be acquired from the property owner in return for payment.

Legislation Needed: The traditional private property approach would require legislation that:

- allocates ownership of pore space (e.g. to the surface owner or to the mineral rights owner),
- defines ownership and liability for injected CO₂, and
- allows for unitization and/or eminent domain to acquire pore space, including pore space owned by state and local governments.

Limited Private Property Approach – CCSREG Concept

Instead of an absolute right to pore space, some commentators have suggested that landowners' rights to deep formations are not absolute.

Legislation Needed: The limited private property approach would require legislation that:

- establishes the process by which pore space property rights are adjudicated,
- defines a "fair" threshold at which a property right to pore space is recognized (e.g., "non-speculative economic interest" in the CCS Reg Project's model legislation), and
- allows for eminent domain of recognized pore space rights, including pore space containing minerals and pore space owned by state and local governments.

Public Resource Approach

Aquifer storage and recovery ("ASR") law could serve as a model for a third approach, a "public resource approach, at least for carbon sequestration in saline formations.

Legislation Needed: The Public Resource Approach would require legislation that:

- recognizes saline formations as public resources for the purposes of sequestration projects; and
- authorizes a public agency to either conduct sequestration operations or to permit private entities to conduct sequestration operations on the public's behalf.

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Recommendation on Monitoring, Verification, and Reporting

In the context of geologic CO₂ storage (GCS), Monitoring, Verification, and Reporting (MVR) refers to activities for collecting and reporting data about the characteristics and performance of GCS projects. For setting state regulatory policy, the primary purposes of MRV will be to verify that projects perform as expected—that ecosystems, local populations, livestock, and natural resources such as groundwater and recoverable oil and gas are protected, that damages from seismicity do not result from injecting CO₂, and that the proposed reduction in CO₂ emissions is achieved.

There are available measurement techniques for detection of leakage and the overarching approaches for combining these techniques into a monitoring program. The major components to be addressed by monitoring in GCS projects include: (1) injection rates and pressure, (2) injection well integrity, (3) subsurface distribution of the CO₂, and (4) the local environment.

Many of the measurement technologies for monitoring GCS are drawn from other applications such as the oil and gas industry, natural gas storage, disposal of liquid and hazardous waste in deep geologic formations, groundwater monitoring, safety procedures for industries handling CO₂, and ecosystem research. These established practices provide numerous measurement approaches and options—a monitoring toolbox—which enables development of tailored, flexible monitoring programs for GCS.

Practical and cost-effective approaches to MVR will rely on a combination of measurements and model predictions, tailored to the geological attributes and risks of specific storage sites. Many current GCS projects involve research elements to further develop or adapt existing measurement tools to the characteristics of CO₂ storage or to test new techniques. This research aims to enhance our understanding of GCS, lower costs, gain lessons learned from field testing, and expand the options of an already robust monitoring toolbox.

The inherent variability in geologic environments call for flexibility in the MVR methods used, types and numbers of parameters measured, and the temporal and spatial frequency of their measurement. A consistent monitoring policy amongst regulatory entities will be essential to enable project developers to build unified, tailored monitoring programs that will allow GCS projects to move forward in a cost- and time-effective manner, while ensuring protection of the public, the environment, and natural resources.

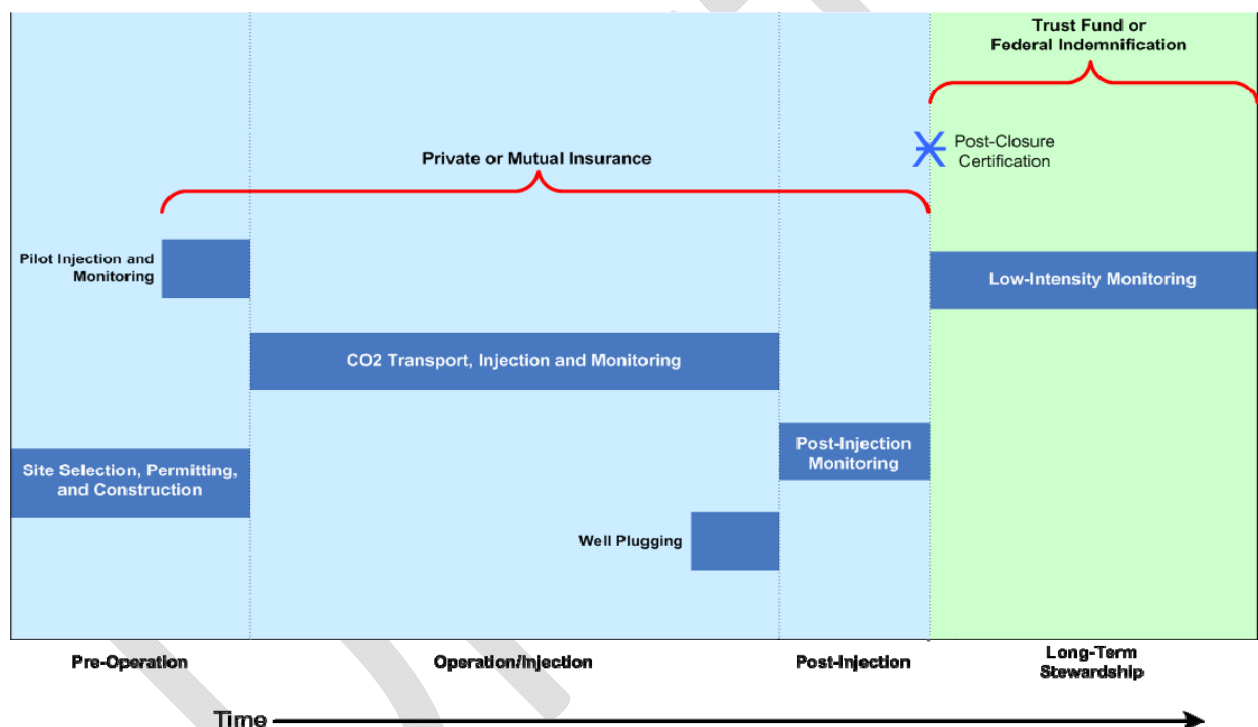
Recommendations:

- Continue research to further develop or adapt existing measurement tools and test new MVR techniques. Adapt a consistent measurement and modeling protocols among state regulatory agencies to allow geologic CCS projects to move forward.

Recommendations on Long-Term Liability and Long-Term Stewardship

Understanding the issues behind long-term stewardship and long-term liability requires a degree of technical knowledge and experience, but primarily requires legal and financial expertise. The references in Appendix C go into more depth in these areas. At this stage it is unclear whether new Federal post-closure stewardship and liability requirements will apply to sequestration projects, although relevant legislation has been introduced¹. In the absence of special legislation, established liability regimes and responsibilities apply to projects.

Although the risk profile of geologic storage sites is typically expected to be highest during the injection phase when pressures in the subsurface are highest, it is important to monitor the performance and safeguard the integrity of projects after an injection site is closed. Because CO₂ must stay permanently stored, it is prudent from an environmental and public safety perspective to task a governmental entity, as opposed to a private sector entity, with site stewardship obligations commencing with the beginning of the post-closure phase (see Figure X). California should ensure the same for projects within its boundaries.



Recommendation:

To that effect, the state should first of all set criteria for site closure that establish that the CO₂ is permanently trapped and is expected to remain so, and that the operational phase may safely be terminated. These should be consistent with the new Underground Injection Control regulations for CCS that the U.S. Environmental Protection Agency (EPA) finalized on November 22, 2010². [A designated agency] should then take over the duties of monitoring, maintenance, mitigation and remediation, subcontracting as necessary. Funding for those activities should be provided through a dedicated trust fund that cannot be used for other purposes, into which operators pay at initial permitting and during the operational life of projects. The trust fund's size should be adjusted to be sufficient for the necessary tasks, levying operators where necessary and refunding excessive balances where appropriate and as long as its integrity in reasonable eventualities is not compromised. A post-closure monitoring program plan should be proposed by the operator at the time of permitting along with cost estimates, updated during the active life of the project as data becomes available, and vetted by an expert independent body at the time of closure. The new

¹ S. 1462, the American Clean Energy Leadership Act of 2009, and S. 3591, the Carbon Capture and Sequestration Deployment Act of 2010 have been introduced, and S. 1462 has been approved by a congressional committee.

² New Class VI injection wells under the UIC Program.

GHG reporting regulations for geologic sequestration projects that EPA finalized on November 22, 2010³ include requirements for site “Monitoring, Reporting and Verification” appear to address some of these topics during the operational phase of a site, and should be considered for the post-closure stewardship period too.

To the question of who bears the residual legal and financial liability beyond what the stewardship agency and trust fund cover, we note competing factors. Liability relief for operators could create moral hazard that jeopardizes the safety and performance of projects, and can be at odds with public acceptance of CCS technology. In addition, calls for liability relief do not seem consistent with the widely accepted, manageable risks of CCS based on today’s best science.

Nonetheless, the private entities which will likely need to utilize CCS as a mitigation option will often not be the ones with relevant subsurface expertise and understanding of the risks, which has resulted in a reluctance on their part to invest in the technology in the face of seemingly unknown financial risks. As such, lack of liability relief might act as a deterrent to the development of some projects. In addition, companies do not last forever, but may be bought and sold or may declare bankruptcy. A recourse gap may therefore arise after the demise of a company, depending on the successorship of its management and assets, which could undermine the goal of good site stewardship and public confidence in projects.

Recommendation:

An acceptable solution for liability must accommodate environmental, public safety as well as commercial concerns. Some states have legislated on the issue and limited liability for operators, while others have refrained from doing so. We do not recommend that California relieve operators of liabilities but rather ensure that any Federal action that may emerge in the years ahead represents the state’s interests. The state should therefore monitor and engage in developments at the Federal level in a way that represents the diversity of stakeholders and interests within its borders.

³ Subpart RR to EPA’s Greenhouse Gas Reporting Rule.

Recommendations for Permitting and Regulation of Pipelines

Developing a pipeline transportation infrastructure between capture and sequestration sites may encounter challenges in technology, cost, regulation, policy, rights-of-way, and public acceptance. Such an infrastructure already exists for natural gas, and CO₂ pipelines already exist, therefore the challenges are not anticipated to be major barriers to deployment. The areas addressed below are safety, siting, and rate regulation.

Safety

CO₂ Pipelines should continue to be regulated as they currently are under PHMSA. No new regulatory structure is needed. The State Fire Marshal could implement these requirements using existing authority. If it is concluded that legislative clarification is needed, the authority should be accomplished by adding CO₂ transportation pipelines to the State Fire Marshal's authority in addition to hazardous liquids pipelines, and not by changing the category of CO₂ to a hazardous liquid.

Siting

CCS related site access rights could be legislatively addressed through a relatively small change to the language in existing statutes that provide authority for natural gas storage. The legislative action would be to amend the current language to include CCS. The authority in existing California law for underground natural gas storage condemnation is in the CPUC. A few extra steps would be needed to include such language in the statutory authority of the CEC. A memorandum developed by the technical advisory committee titled "Establishing Eminent Domain Authority for Carbon Storage in California" (Nov 4, 2010) provides sample amendments that would extend condemnation authority to carbon sequestration facility operators following the natural gas storage model. This would cover storage / pore space access as well as pipeline right of way. While there are pros and cons to legislative action in this area, and such legislation should be approached with caution due to the public sensitivities, legislation authorizing the use of eminent domain for CO₂ pipelines would likely further the implementation of carbon sequestration.

Rate regulation

CO₂ pipelines' rates and services should be left to commercial contracts, primarily because of uncertainty as to who will own and operate such facilities, and what business model the providers of these services will use. In addition, early pipeline projects are likely to be designed for exclusive use of pipeline capacity by a project developer as part of an integrated capture/transport/storage project. Regulatory action on rates could add complexity for these early projects without significantly furthering the implementation of carbon sequestration.

Recommendations:

Safety: No new regulations are needed.

Siting: A change in legislative language to include CCS would address CCS-related site access rights

Rate Regulation: Pipelines rates and services should be left to commercial contracts.

Recommendations for Economic Incentives to Accelerate CCS Technology Demonstration and Early Deployment in California

Although many GHG stabilization studies forecast CCS to be a major contributor to GHG emissions reduction, especially in the period after 2020, CCS is not practiced in an integrated, commercial manner today at the scale necessary to make meaningful reductions in man-made GHG emissions. Thus, governments and regulatory bodies have been acting to accelerate CCS technology development, demonstration, and early deployment through public policies and financial incentives.

Financial incentives to encourage investment in CCS tend to address one of three cost centers: capital cost, financing cost, and operating cost. For example, the federal government has offered investment tax credits and U.S. Department of Energy (DOE) cost share grants to reduce capital costs, DOE loan guarantees to reduce financing costs (and increases the likelihood of financial closure), and per-ton sequestration tax credits and accelerated depreciation to reduce net operating costs.

State government incentives can also address these cost centers through programs similar to those offered by the federal government. One rationale for California “topping off” federal CCS incentives is the recognition that costs for land, labor, materials, and utilities tend to be higher in California than the national average (by perhaps by 20% overall), and thus a higher total value of incentive would be needed here to engender the desired degree of market response.

In addition, states can offer credits or exemptions to taxes uniquely imposed at the state/county level, such as property taxes. California currently offers, for example, a property tax exemption for certain investments in renewable energy technologies, and it could consider a similar policy for CCS equipment.

Utility rate regulation is another area where states traditionally have jurisdiction. The California Public Utilities Commission (CPUC) has authority over cost recovery for power plants built or owned by investor-owned utilities, and for long-term power purchase contracts by investor-owned utilities from plants developed and operated by independent generators. CPUC can approve “above market” costs for power from CCS-equipped plants deemed to be in the public interest, although such above-market costs may adversely affect regulated utilities’ competitiveness in the retail electric market because California consumers have access to non-utility energy service providers. It would be beneficial to clarify cost allocation mechanisms available to CPUC to socialize the above-market costs to all customers so that utility customers alone do not bear the cost for the public-interest benefit of commercial CCS introduction.

Because CCS increases the variable operating cost of power plants, they may be temporarily uncompetitive in traditional dispatch models relative to plants without CCS, particularly in the era immediately after GHG regulations take effect, when allowance price caps and/or other measures limit the price of CO₂ emission allowances. Although the California Independent System Operator has mechanisms to prevent dispatch curtailment for fossil power plants with CCS—typically designation as “must run” units—explicit affirmation of the place of fossil power plants with CCS in California’s “preferred loading order” is desirable.

Finally, if any portion of annual GHG allowances is distributed via auction, a portion of the resulting revenue may be targeted to clean energy technology demonstrations (including CCS). Bonus allowances for early CCS adopters have also been proposed as a means to offset competitive challenges in the years immediately following application.

Recommendations:

- California should establish a package of tax credits, exemptions, and rules (e.g., accelerated depreciation) for CCS investments “on top of,” and in addition to, federal tax incentives for CCS investments and operations. New legislation may be needed for some types of tax incentives.
- The California Public Utilities Commission should establish a cost allocation mechanism for early CCS projects that spreads broadly across California ratepayers the above-market costs of projects that share their experience-based knowledge for public benefit.
- Updates to the California Energy Action Plan should establish fossil power plants with CCS as a preferred type of power generation.

- The Air Resources Board should design the AB 32 GHG emission allowance allocation program to encourage early applications of CCS and associated experience-based knowledge sharing.

DRAFT

Recommendations for CCS Public Outreach in California

In developing policies for CCS, California's agencies will want to use transparent processes and provide multiple opportunities for public input. Companion efforts to further public education on CCS will be essential to meaningful public engagement. It is also the intent of the Panel to express that no particular community or portion of a community should be burdened by the impact by CCS activities beyond those expected of industrial activities on this scale.

Recommendations:

- Allocate sufficient time and resources to support an inclusive outreach effort
- Engage and provide a public forum for knowledgeable independent experts on CCS subjects
- Communicate the scope, methods, and findings of risk assessments in an honest and open manner
- Communicate in the language and through the channels most familiar to target audiences
- Provide ample and non-intimidating vehicles for public comment
- Keep outreach materials up-to-date and aligned with policy developments
- Look for opportunities to share and coordinate outreach materials among agencies